REMARKS

Claims 1-9 are now pending in the application. Claims 1 and 6 have been amended have been amended to include a water transfer device comprising a plurality of conduits made of a water transfer membrane contained in a housing unit such that the cathode effluent flows between voids around the conduits and a second gas flows across the tops of the conduits to facilitate water vapor exchange. Claims 1 and 6 have also been amended to clarify that "dew point" refers to the dew point of water. Support for the amendments may be found throughout the Specification, for example in Paragraphs [0053] and [0054]. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 103

Claims 1-3 and 5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Voss et al. (U.S. Pat. No. 6,106,964) in view of Dantowitz et al. (GB 2139110). This rejection is respectfully traversed.

Voss et al. discloses a fuel cell system and method for humidifying and adjusting the temperature of a reactant gas stream therefor that appears to be the reverse arrangement of Applicants' invention. Voss et al. teaches in Figure 2 and at columns 9 and 10 that the combination heat and humidity exchanger module 400, which contains CHHE membrane 410, is in direct heat transfer with fuel cell stack 300. By this arrangement, the cathode exhaust from the stack is further heated by its position in heat transfer relationship with stack 300. Thus, the exhaust gas stream is heated, and then vapor transfer occurs across membrane 410 to the cathode supply. It is further stated

at column 10 that it is advantageous to orient the CHHE module 400 on the stack so that "the exhaust reactant air is preferably directed through the secondary chamber 430 from the region of the chamber located closer to a warmer portion of the stack 300" (see column 10 at lines 50-55). It is further stated that the arrangement of the CHHE module 400 in direct thermal contact with fuel cell stack 300 in operation, permits heat emanating from the stack to contribute to the heating of the exhaust emanating from the stack (columns 9 and 10).

Accordingly, Voss et al. teaches the reverse of the arrangement of claim 1 of the present invention whereby "the temperature of said cathode effluent at said device cathode effluent input is not significantly greater than the temperature of said cathode effluent at said cathode output". The flow patterns of the dry stream (to be humidified) and the wet stream (source of humidity) in the present invention have been optimized to enhance water transport from wet to dry. The dry stream temperature and pressure are controlled to optimize water transport to it, and the wet stream temperature and pressure are also controlled to optimize water transport from it.

Examiner admits that Voss et al. does not suggest or teach Applicants' limitation of maintaining the water in its vapor state and being greater than its dew point and up to about 10°C above its dew point. To remedy the shortcomings of Voss et al., Examiner relies on the vague and wholly insufficient disclosure of Dantowitz et al. which teaches transferring water vapor from one gaseous stream to another gaseous stream in a direct fashion without condensing the water. The Dantowitz et al. gaseous streams are counter flowed in a linear manner through a housing which is separated into two chambers by a gas impervious and water permeable membrane (column 2, lines 86-

130, and Figure 1). The Dantowitz et al. disclosure does not define any range of temperatures for the water vapor and the language cited by Examiner "without having to condense the water" and (page 2, line 44) and "arrangement for humidifying a gaseous stream by transferring gaseous vapor between one stream and another" (page 2, line 55) does not suggest a temperature range and only suggests the state of water vapor. Deriving Applicants' range of "up to about 10°C above its dew point" would be mere guess work in light of the vague disclosure of Dantowitz et al. and would require one skilled in the art to ignore the differences between Applicants' conduit arrangement and the Dantowitz et al. and to haphazardly apply the Dantowitz et al. teachings to a water transport system having a maze of conduits and the complex baffle and cross flow on the tops of the conduits in which the water vapor is transferred through the membranes within the cathode effluent and to the second stream over the tops of the conduits. One skilled in the art would further have to ignore the interrelation of water transport system design, pressure, fluid flow, temperature, and effluent disposal and/or recycling – fundamentals of fuel cell water transport devices – and ultimately disrupt transfer of the water vapor and proper function of the fuel cell.

Accordingly, the combination of Voss et al. and Dantowitz et al. fails to disclose Applicants' fuel cell system where the cathode effluent is maintained at up to about 10°C above the dew point of water and fails to disclose the system having a plurality of conduits to facilitate water vapor exchange. It is respectfully requested that the obviousness rejection for independent claim 1, and by dependence, claims 2, 3, and 5 be withdrawn.

Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Voss et al. in view of Dantowitz et al. as applied to claims 1-3 and 5 above, and further in view of Bloomfield (U.S. Pat. No. 3,976,507).

As stated above, the combination of Voss et al. and Dantowitz et al. does not teach or suggest Applicants' invention. The addition of Bloomfield to the combination of Voss et al. and Dantowitz et al. still fails to teach or suggest Applicants' invention because the Bloomfield patent does not remedy the shortcomings of the Voss and Dantowitz patents.

Unlike the Voss et al, Dantowitz et al. systems, the Bloomfield system shows cathode exhaust 54 being heated in heat exchanger 60. In addition, a fuel inlet stream is combined with the cathode gas effluent and the two are heated in heat exchanger 60 so that a hot moist mixture of cathode gas effluent and raw fuel enters the reactor from heat exchanger 60. It is important to note that any moisture entering the reactor from heat exchanger 60 is moisture which exists in cathode exhaust stream. There is no exchange of moisture. Therefore, Bloomfield teaches two concepts that are completely different from Voss et al. and Dantowitz et al. First, the cathode stream must be heated and combined with the fuel to supply the autothermal reformer. Second, there is no exchange of water from the cathode effluent to an anode supply stream. Accordingly, there would be no motivation for the skilled artisan to consult the Bloomfield patent to modify the teachings of Voss and Dantowitz.

Claims 6-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Voss et al. in view of Dantowitz et al. as applied to claims 1-3 and 5 above, and further in view of Naguchi (JP 6-333583).

As stated above, claim 6 has been amended to include the limitations of claim 1 and the combination of Voss et al. and Dantowitz et al. fail to teach or suggest Applicants' temperature range and conduit arrangement. The addition of Naguchi to the combination of Voss et al. and Dantowitz et al. still fails to teach or suggest Applicants' invention.

Examiner admits that "Voss et al. do not expressly teach that the air is compressed after humidification, as it recited in claim 6." The office action argues that Naguchi "is directed to a fuel cell system comprising a compressor (42) downstream of a cathode supply line humidifier" (43; see Fig. 1). A closer reading of Naguchi shows that the system of Naguchi provides a condenser (44) downstream of compressor (42) which is downstream of cathode supply humidifier (43). In other words, in Naguchi, a cathode stream is first humidified, then compressed, and then water added via the humidifier is re-condensed and removed from the cathode supply before it is fed to the fuel cell. Therefore, it would not be obvious to one of ordinary skill in the art to be motivated by the disclosure of the Japanese reference to combine it with the system of Voss.

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Voss et al. in view of Dantowitz et al. and Naguchi as applied to claims 6-8 above, and further in view of Bloomfield.

As stated earlier, the combination of Voss et al. Dantowitz et al. and Naguchi fails to teach or support applicants' inventions of claims 6-8. Bloomfield does not supply the deficiencies of the combination. Accordingly, it is respectfully submitted that the art does not supply the limitations of claim 9.

DOUBLE PATENTING

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees.

Claims 1-9 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 6,630,260 in view of GB 2139110 and JP 6-333583. The claims as presently amended are not shown to be obvious from the combination of references and it is respectfully requested that the objection be withdrawn.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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